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Space systems — Fluid characteristics, sampling and test methods —

Part 11: Ammonia

Systèmes spatiaux — Caractéristiques des fluides, échantillonnage et méthodes d'essai —

Partie 11: Ammoniaque

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 3.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this part of ISO 15859 may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15859-11 was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

ISO 15859 consists of the following parts, under the general title *Space systems — Fluid characteristics, sampling, and test methods*:

- *Part 1: Oxygen*
- *Part 2: Hydrogen*
- *Part 3: Nitrogen*
- *Part 4: Helium*
- *Part 5: Nitrogen tetroxide propellants*
- *Part 6: Monomethylhydrazine propellant*
- *Part 7: Hydrazine propellant*
- *Part 8: Kerosine propellant*
- *Part 9: Argon*
- *Part 10: Water*
- *Part 11: Ammonia*
- *Part 12: Carbon dioxide*
- *Part 13: Breathing air*

Introduction

This International Standard specifies limits for the composition of ammonia (NH_3) and establishes the fluid sampling and test methods for ammonia intended for use in coolant and servicing space systems. The purpose of this International Standard is to establish uniform requirements for the composition, sampling, and test methods for ammonia used in the servicing of launch vehicles, spacecraft, and ground support equipment.

Fluid operations at a spaceport or launch site may involve a number of operators and supplier/customer interfaces, from the fluid production plant to the delivery to the launch vehicle or spacecraft. The fluid composition limits specified in this International Standard are intended to define the purity and impurity limits of the fluid for loading into the launch vehicle or spacecraft. The fluid sampling and test methods included in this International Standard are intended to be applied by any operator. The fluid sampling and test methods presented in this International Standard are acceptable methods for verification of the fluid composition limits.

Space systems — Fluid characteristics, sampling and test methods —

Part 11: Ammonia

1 Scope

This part of ISO 15859 specifies limits for the composition of ammonia (NH_3) and defines the fluid sampling and applicable test methods for verification of its composition. This International Standard establishes acceptable composition test and sampling requirements. This International Standard applies to sampling and test methods for ammonia used in both flight hardware and ground support facilities, systems, and equipment. It is applicable to influents ammonia only to the extent specified herein.

CAUTION — Ammonia, in the liquid or gaseous form, is toxic. Care should be taken in the handling and storage of ammonia to prevent contact with the human body and with materials that are not compatible with ammonia.

This part of ISO 15859 is applicable to any sampling operation required to ensure that, when the fluid enters the launch vehicle or spacecraft, the fluid composition complies with the limits provided hereafter or with any technical specification agreed to for a particular use.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this part of ISO 15859. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this part of ISO 15859 are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7103:1982, *Ammonia – Liquefied anhydrous ammonia for industrial use – Sampling – Taking a laboratory sample.*

ISO 7104:1985, *Ammonia – Liquefied anhydrous ammonia for industrial use – Determination of water content – Gas chromatographic method.*

ISO 7105:1985, *Ammonia – Liquefied anhydrous ammonia for industrial use – Determination of water content – Karl Fischer method.*

ISO 7106:1985, *Ammonia – Liquefied anhydrous ammonia for industrial use – Determination of oil content – Gravimetric and infra-red spectrometric methods.*

ISO 8402:1994, *Quality management and quality assurance – Vocabulary.*

3 Terms and definitions

For the purposes of this part of ISO 15859, the terms and definitions given in ISO 8402 and the following apply:

3.1**indirect method**

method of measuring fluid purity by indirect means, that is, measuring the aggregate impurities, as a volume percent or percent by weight and subtracting it from 100

3.2**verification tests**

analyses performed on the fluid in the container, or a sample thereof, which is representative of the supply

4 Composition**4.1 Limits**

The composition of ammonia delivered to the flight vehicle interface shall be in accordance with the limits given in Table 1 when tested in accordance with the applicable test methods.

Table 1 – Composition limits

Composition		Limit
Purity ^a	mass fraction, %, min.	99,98
Water	µg/g, max.	50
Oil	µg/g, max.	6
Total nonvolatile residue		b
Chlorides	µg/g, max.	1
Fluorides		b
^a Determined by indirect method. ^b Record and report only.		

4.2 Procurement

The ammonia specified in Clause 1 should be procured in accordance with an applicable national standard.

5 Fluid sampling**5.1 Plan**

In order to ensure that the fluid composition complies with the limits specified in this International Standard, a fluid sampling plan should be established by all the involved operators, from the production to the space vehicle interface, and approved by the final user. Such plan shall specify:

- the sampling points;
- the sampling procedures;
- the sampling frequency;

- the sample size;
- the number of samples;
- the test methods;
- the responsibilities of any involved operator.

CAUTION — Ammonia, in the liquid or gaseous form, is toxic. Care should be taken in the handling and storage of ammonia to prevent contact with the human body and with materials that are not compatible with ammonia.

Sampling may be performed in accordance with ISO 7103 or the following subclauses.

5.2 Responsibility for sampling

Unless otherwise provided in an applicable technical specification, the ammonia delivered to the flight vehicle interface shall be sampled and verified by the supplier responsible for providing the ammonia to the flight vehicle. The supplier may use its own or any other resources suitable for the performance of the verification tests specified herein unless otherwise directed by the customer.

5.3 Sampling points

Unless otherwise specified, sampling shall be conducted at the fluid storage site or the flight vehicle interface.

5.4 Sampling frequency

Sampling shall be annually or in accordance with a time agreed upon by the supplier and the customer.

5.5 Sample size

The quantity in a single sample container shall be sufficient to perform the analysis for the limiting characteristics. If a single sample does not contain a sufficient quantity to perform all of the analyses for the required quality verification test, additional samples shall be taken under similar conditions.

5.6 Number of samples

The number of samples shall be in accordance with one of the following:

- a) one sample per storage container;
- b) any number of samples agreed upon by the supplier and the customer.

5.7 Storage container

Unless otherwise provided by the applicable sampling plan, the fluid storage container shall not be refilled after the time the sample is taken.

5.8 Gaseous samples

Gaseous samples shall be a typical specimen from the gaseous ammonia supply. For safety reasons, the sample container and sampling system must have a rated service pressure at least equal to the pressure in the supply container. Samples shall be obtained in accordance with one of the following:

- a) by filling the sample container and storage containers at the same time, on the same manifold, and under the same conditions and with the same procedure;

- b) by withdrawing a sample from the supply container through a suitable connection into the sample container. No pressure regulator shall be used between the supply and the sample containers (suitable valves are permissible);
- c) by connecting the container being sampled directly to the analytical equipment using suitable pressure regulation to prevent over-pressurizing this equipment.

5.9 Liquid samples (vaporized)

Vaporized liquid samples shall be a typical specimen from the liquid ammonia supply. Samples shall be obtained in accordance with one of the following:

- a) by vaporizing, in the sampling line, liquid from the supply container;
- b) by flowing liquid from the supply container into or through a suitable container in which a representative liquid sample is collected and then completely vaporized.

5.10 Rejection

When any sample of the fluid tested in accordance with Clause 6 of this International Standard fails to conform to the requirements specified herein, the fluid represented by the sample shall be rejected. Disposition of the rejected fluid shall be specified by the customer.

6 Test methods

6.1 General

The supplier will ensure, by standard practice, the quality level of ammonia. If required, alternate test methods are described in Clause 6 of this International Standard. Other test methods not listed in this International Standard are acceptable if agreed upon between the supplier and the customer.

These tests are a single analysis or a series of analyses performed on the fluid to ensure the reliability of the storage facility to supply the required quality level. This can be verified by analysis of representative samples of the fluid from the facility at appropriate intervals as agreed upon between supplier and the customer. Tests may be performed by the supplier or by a laboratory agreed upon between the supplier and the customer.

The analytical requirements for the tests shall include the determination of all limiting characteristics of ammonia.

6.2 Parameters of analysis

The parameters for analytical techniques contained in this section are:

- a) purity shall be expressed as a percentage (%) by weight;
- b) calibration standards containing the applicable gaseous components may be required to calibrate the analytical instruments used to determine the limiting characteristic levels of fluid;
- c) if required by the customer, the accuracy of the measuring equipment used in preparing these standards shall be traceable to an established institute for standards;
- d) analytical equipment shall be operated in accordance with the manufacturer's instructions;
- e) analytical methods not listed in this International Standard are acceptable if agreed upon between the supplier and the customer.

6.3 Ammonia purity

The ammonia concentration shall be determined by indirect method, that is by measuring the aggregate water and oil impurities, as a percent by weight, and subtracting it from 100.

6.4 Water content

The water content shall be determined by one of the following procedures:

- a) by a gas chromatographic method in accordance with ISO 7104;
- b) by a Karl Fischer method in accordance with ISO 7105.

6.5 Oil content

The oil content shall be determined by an infrared spectrometric method in accordance with ISO 7106.

6.6 Nonvolatile residue content

The nonvolatile residue contents shall be determined by the infrared spectrometric method in accordance with ISO 7106, except that the separatory funnel and filtration steps will be deleted. Identify the residue constituents by the infrared spectrometric method.

6.7 Chloride content

The chloride content shall be determined by an ion chromatographic method.

6.8 Fluoride content

The fluoride content shall be determined by an ion chromatographic method.